2 pages
N66-85431

VHF Absorption, Cosmic Ray ~~Comic RAy~~ and Geomagnetic Field Correlation, and Satellite Observations

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Fourth Semiannual Status Report

(NsG-614)

1 October 1965 - 31 March 1966

I. The fixed frequency riometer continues to perform very satisfactorily. We have had essentially no down time with the apparatus and the two methods at our disposal for checking indicate that the reproducibility of the instrument is excellent. The two methods are the following: (a) During unusual events it is possible to check the general shape, excursions, and deviations of the record against the records of other experimenters at other locations. As a matter of fact, one of these events produced such identical records at Bedford, Massachusetts and Durham that only the most detailed study revealed differences in the patterns of the two observing sites. (b) Our second check is the similarity of recordings on magnetically quiet days. The average of these low Kp value days forms the basis for the computation of absorption indices. To date our records show a high correlation on these quiet days.

At present, our studies are proceeding in three directions: (1) development of a computer program which will alleviate the time consuming hand calculations we presently make to obtain absorption values at a particular time of day; (2) a continuation of the theory outlined in our proposal extension request which indicates that it might be possible to obtain electron distributions by use

of riometers at several frequencies; and, (3) a continued study of the 18 April 1965 event. For this latter we have collected riometer data from several stations in Canada, one in Norway, two in Sweden, one in Brazil, as well as several in the U.S.A. In addition, we have magnetometer data and several cosmic ray observations. A pattern is gradually beginning to develop from all of these observations, and we are in the process of writing a paper in this regard. In addition, we have submitted this work, as well as one other, as a paper to be presented at the Washington meeting of URSI.

II. Twice during this report period the satellite tracking equipment has failed to function properly for a period of a week or more. The first time the trouble was traced to an intermittant in one of our multiplying stages. As the equipment requires stability to one part in 10^9 over a satellite pass for all generated frequencies, we have used the procedure of deriving all frequencies from a common crystal oscillator. To achieve the stable mixing frequencies for the dual conversion receives, we use a multiplier followed by a free running oscillator and phase detector network. The free running oscillator signal is phase-compared to the strongest signal from the multiplier (i.e., the desired harmonic). Any deviation (of more than 2°) of the free running oscillator causes a voltage signal to develop in the phase comparator which in turn retunes the free running oscillator to the exact frequency required. It was in this chain that our trouble developed. The second phase of our trouble was more serious and while temporary measures have primarily overcome the problem, it still recurs at odd intercals.

An error in the logic of the method for analysis of these data has been discovered and is currently being worked upon. It is anticipated that this will be corrected in the near future.